

Information asymmetry and assistive technology: the role of brokerage services

Project Report Authors:

Nathan M D’Cunha, Stephen Isbel, Diane Gibson, Nenad Naumovski,
John Goss

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1. Synopsis: the findings at a glance

The findings of the scoping review of the current literature highlight that potential AT users and AT users desire greater access to information from trusted sources. Trusted sources include health professionals who can confer advice without bias and peers/other AT users with experience using existing AT. Existing models of AT dissemination focus primarily on addressing deficits in knowledge. However, the evidence indicates the need for a holistic approach to enhance quality of life that includes enabling potential AT users to make their own decisions, trial existing AT where possible, and be made aware of new technology. Potential AT users and current AT users want to be involved in the AT selection and service delivery process, which has been demonstrated to lead to better outcomes and satisfaction. Brokerage services that follow these principles, report favourable client outcomes. In particular, the importance of demonstrations prior to purchase, and training AT users in the use of the equipment, were highlighted to be beneficial. From both theoretical and practical perspectives, brokerage services are reported to be beneficial to people selecting AT.

2. Executive Summary

2.1. The problem:

In the selection of assistive technology (AT), consumers are often at a disadvantage as they do not have the experience or knowledge to make the most informed choice about what can meet their needs. This is sometimes called ‘information asymmetry’. Information asymmetry describes the unequal distribution of information whereby an AT supplier, service provider or healthcare practitioner holds more information than a consumer, which in some instances can lead to the inappropriate selection of AT.

What occurs in Australia now:

Consumers have several ways of gaining information about the most appropriate AT for them. Consumers can go directly to suppliers of AT to purchase equipment. They can consult with expert clinicians in the areas of AT. They can also access AT devices under state and federally funded schemes, typically under the direction of experts or healthcare professionals, to identify a suitable product(s) from a regulated list of products or product specifications, which may have established prices or reimbursement thresholds (National Disability Insurance Agency, 2021a).

Assistive Technology AustraliaTM (ATA) has requested this report on the current evidence surrounding information brokerage services in AT. ATA provides information, advice, expertise, training, and spread awareness around AT and its role in aiding independent living. To overcome information asymmetry, ATA aims to provide “impartial advice, information and leadership that builds capacity and optimises the value of AT in leading a life of choice”. Brokerage is seen as a critical aspect of this process.

The role of brokerage:

Independent parties acting as a broker by providing information and advice, and assisting in the acquisition of information or services, have the potential to bridge the gap between the service provider or seller and the consumer. Brokerage may improve consumer outcomes, especially for vulnerable people and people living with disabilities. However, the role that brokerage can play in addressing information asymmetry and potentially improving outcomes in the selection of AT is not well understood.

This scoping review was undertaken to address that issue by exploring available evidence on the following questions:

1. What are the implications of information asymmetry for the delivery of AT?\
2. Are there effective, efficient and equitable ways of providing information brokerage services to people needing AT?

Scoping Review Methodology:

This scoping review aimed to evaluate the current literature to determine whether, and in what ways, brokerage was beneficial for people seeking AT. Ten electronic databases were searched for articles published since journal inception up until July 2021 to identify intervention and observational studies and articles directly related to information asymmetry and brokerage in the context of AT. From a potential 424 articles found, we identified 33 articles that could provide information to answer the research questions. In addition to our analysis of peer-reviewed published literature, a preliminary scan of web-based resources and services was undertaken to provide further context to the scale and location of AT services worldwide.

The identified articles are summarised under five broad headings in the main body of the report: (a) access via trial centres and associated service delivery systems; (b) modes of information dissemination; (c) user preferences in accessing information; (d) models of service delivery and consumer involvement; and (e) challenges and barriers in accessing information.

Synthesis of findings:

AT brokerage services that involved an **independent advisor** were more effective at identifying the appropriate AT for the user and ensuring that the consumer has as much information as possible, and this was associated with more sustained use of the AT. This included the use of **trial centres** and voucher schemes which both **enable consumers to take an active role** in the decision-making process and purchasing of AT.

AT services play a valuable role in ensuring AT users have the required information, the **opportunity to test** to the AT, and the **ongoing knowledge** to both use the AT and access new AT as it becomes available. **Awareness of new and emerging AT** was seen as necessary by users. In addition to having an opportunity to test the AT, users also want to be trained in how to use it after the purchase is made. **Training in the use of AT** was

associated with greater benefits. This is supported by evidence that AT users have better outcomes when they are involved and engaged throughout the entire service delivery process.

An absence of comprehensive information was identified as a barrier to appropriate and efficient access and use of AT. A key finding was that **information asymmetry contributed to awareness limitations** whereby the end-user has minimal knowledge of the potential benefits of a product or even the existence of a potentially helpful product. In this case, the stakeholders want the information they hold to be readily available and accessible so end users can decide what could be beneficial to them.

In the literature, there were both articles describing services provided by countries and municipalities, and smaller, more focused services. The current trend for larger services appears to incorporate **a collaborative, complementary approach whereby web-based information is available to potential AT users, and smaller local centres enable people to test the AT and ask specific questions** while they seek the AT most suitable for their condition. Approaches that enabled potential AT users to access information on AT, the opportunity to trial the AT, and support in using the AT were successful and supported by participant feedback. In addition, there was some evidence that larger providers resulted in a greater likelihood of the right product being found by the person who needs it.

Web-based repositories also play a crucial role in **enabling AT users to complete background research and facilitating communication with other AT users**. Several internet repositories and databases were identified which provide information about currently available AT, and some of these included reviews from prior or existing users. **The experience of peer users** was also valued by AT users.

While web-based resources and information from peers and other AT users are valuable resources, the role of independent expert advice remains an important component, as does the opportunity for testing the equipment and receiving training on it. Access to web-based information is an essential complementary resource in ensuring the most suitable AT is sourced successfully and sustainably.

Gaps in the literature:

There is a lack of information and research within the Australian context. As AT is often funded by state and federal government programs with specific requirements for how AT is accessed and what can be accessed, active investigation is required to establish the value in the Australian context of the systems and strategies identified in this report.

The Main Report

3. Background

In its many forms, assistive technology (AT) can enable people with disabilities of all ages to do things they may otherwise be unable to do, maintain their independence and promote well-being (World Health Organization, 2018). Worldwide, AT is used by more than 1 billion people (World Health Organization, 2018), although variability in the definition of what constitutes AT may limit the ability to identify the number of users accurately. It is estimated that one in ten Australians are using a form of AT (Assistive Technology Suppliers Australiasia, 2018). AT is often described as an umbrella term which is used to describe any system or device which supports personal independence or well-being. Most commonly, this includes mobility aids like wheelchairs or walking frames and communication aids such as a hearing aid or spectacles (World Health Organization, 2018).

Often, a combination of devices and technologies are used to meet an individual's needs. A range of available assistive technologies can contribute to functional ability and independence, such as providing assistance with mobility, tasks of daily living, communication, and recreation. Although facilitating access to these technologies has been identified as a human right as outlined in the United Nations Convention on the Rights of Persons with Disabilities (United Nations, 2016), there is a range of barriers that may be faced by people who access these technologies including those that are financial (de Witte et al., 2018).

In their paper, Steel et al. (2016) use the term 'AT users' to describe people who seek benefit for living with an impairment by using AT (Steel & Layton, 2016). Individuals who may benefit from using AT are 'potential AT users', while 'AT consumers' include AT users, potential AT users, and their carers. This terminology has been adopted in this report.

In the Australian context, the acquisition of assistive technologies can be supported by the National Disability Insurance Scheme (NDIS), My Aged Care, and the Department of Veteran Affairs Rehabilitation Appliances Program. However, the majority of AT purchases are funded privately. There is some evidence of affordability and fairness in pricing, which may reduce some of the barriers to access (Summers & Verikios, 2018), although the potential for improved delivery of AT services has been identified (Steel & Layton, 2016).

In Australia, there are around 2.4 million Australians with a disability under the age of 65 (Australian Bureau of Statistics, 2019). Around 500,000 of those are eligible and have been approved to access approximately AUD \$22 billion through the National Disability Insurance

Scheme (National Disability Insurance Agency, 2021b) to purchase goods and services that are reasonable and necessary to support people in their everyday lives. This can include AT, which can be purchased by individuals accessing the NDIS, usually through an assessment process that is meant to match an individual's need to appropriate AT (National Disability Insurance Agency, 2021a).

There are also 1.9 million Australians aged 65 and over with a disability who by virtue of age of onset of their disability at the inception of the scheme are not entitled to access AT through the NDIS. Publicly funded access to AT for those aged 65 and over is regarded as more limited and fragmented than that for those under 65. Nonetheless, AT is recognised as an important resource to support independent living for persons of all ages (Beale, 2021; National Aged Care Alliance, 2018).

The following research questions guided the scoping review:

- What are the implications of information asymmetry for the delivery of AT services?
- What are effective, efficient and equitable ways of providing information brokerage services to people needing AT?

4. Methods

To examine the existing methods of provision of AT and evidence of information asymmetry in the existing literature, a scoping review was undertaken and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018). Due to the broad scope of AT's and the diverse nature of the provision of the technology, a scoping review was suitable to explore the current evidence base.

Search strategy

The search strategy was developed in consultation with a librarian. The search strategy was: ("assistive technolog*" OR "health consumer*") AND ("disseminat*" OR "broker*") AND "information". The search strategy was intentionally broad and used consistently across databases. The databases searched were EBSCO Medline, EBSCO Cinahl, Academic Search Ultimate, Business Source Ultimate, Proquest Central, Scopus, Web of Science, PsychINFO, EconLit, and JSTOR. All databases were searched from database inception until the searches were performed on the 18th of July, 2021. The reference lists of relevant review articles and articles selected for full-text screening were also used to potentially identify pertinent articles.

Eligibility criteria

To be included in the review, articles needed to address AT access under the broad scope of involving information asymmetry or brokerage. All study designs were eligible for inclusion in the review. In particular, we aimed to identify studies with human participants (intervention, observational, survey, qualitative, mixed methods, case studies, and case series studies); studies that related to AT access provided through a brokerage service; and opinion articles, editorials, or policy documents that specifically discussed information asymmetry or brokerage. Studies were excluded if they were review articles, protocols, methodological or validation articles or published in a language other than English.

Selection of sources of evidence

Articles identified during the database searches were imported into EndNote, and duplicates were removed. All records were exported and uploaded to Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia). Two authors first screened for eligibility based on titles and abstracts according to the eligibility criteria. For any articles where this was unclear, the article was carried forward into the full-text review. Two authors independently reviewed the full text of the remaining papers, and eligible studies were included. In the full-text review, articles were assessed against the eligibility criteria. Disagreements were managed by discussion to reach consensus or by a third reviewer, where needed.

Data extraction

To address the research questions of this scoping review, all articles were read and summarised to determine: 1) the study aim, 2) methods, 3) results, and relevance to information asymmetry or brokerage in relation to AT use.

Search results

In total, 537 articles were sourced across all databases. After the removal of duplicates, 407 articles remained. Eighty-five articles met the criteria for full-text screening, and 33 articles met the final inclusion criteria. The flow chart of the search procedure is presented in Figure 1.

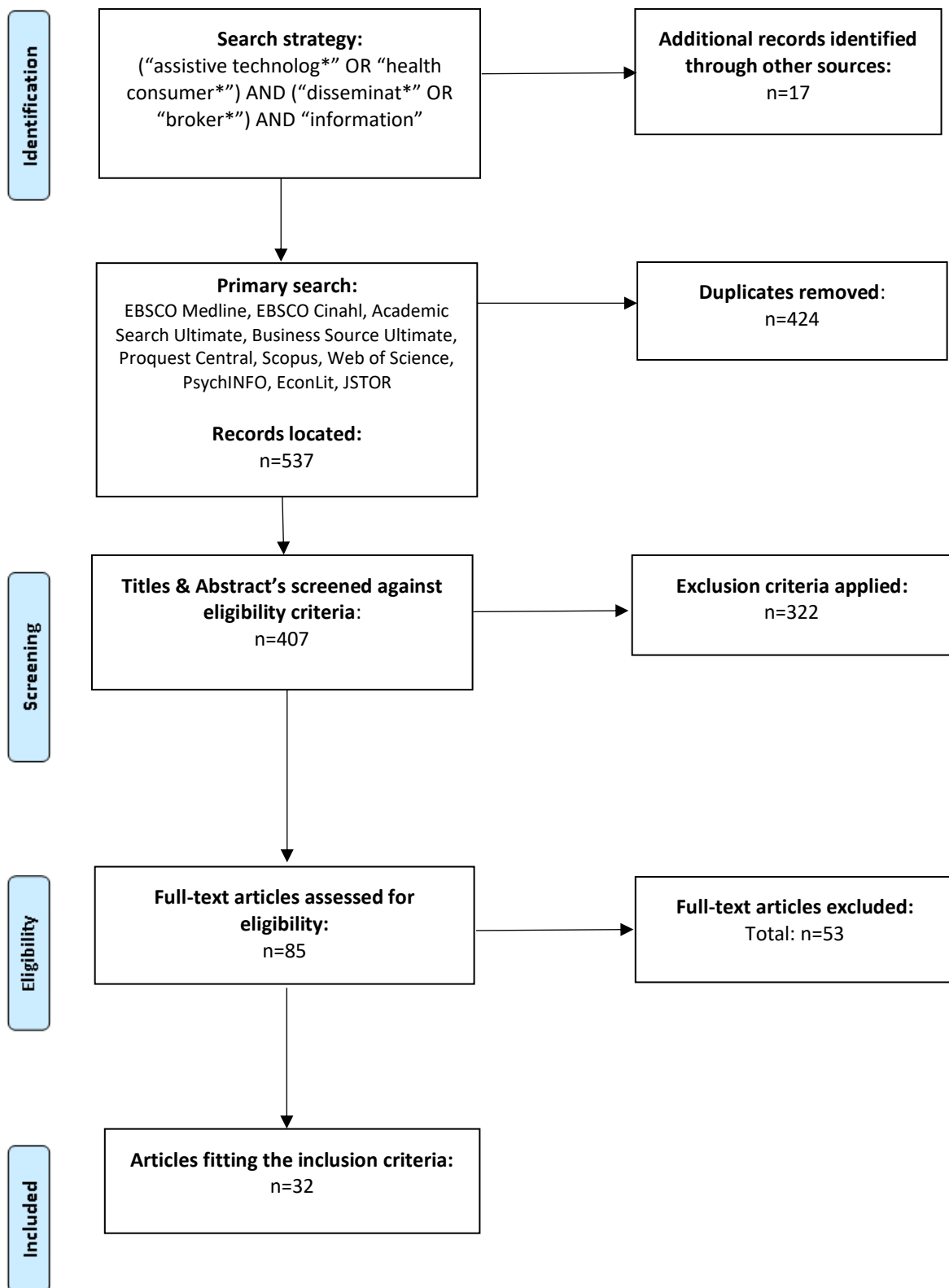


Figure 1. PRISMA flow chart summary of scoping review search process (Tricco et al., 2018).

5. Findings

Characteristics of included studies

The literature was synthesised under common themes:

- Access to AT via trial centres and service delivery systems: articles that describe the national or regional service delivery system, including centres where AT can be trialled.
- The type of information, mode of dissemination, and target recipient: The studies describe web-based platforms to disseminate AT information, a children's television program, and voice mail service.
- Where are consumers getting information vs. where do they say they want to get this information from – what is the impact of different information sources?: The studies described different ways potential AT users and stakeholders seek information and their preferred sources.
- Consumer involvement in the development of AT delivery models: articles that described different theoretical approaches to AT information dissemination and brokerage.
- Challenges with accessing AT and the role of information asymmetry: these studies describe some of the challenges, barriers, and structural issues with the provision of AT information.

Access to Assistive Technology via trial centres and service delivery systems

Several articles explored either national or regional service delivery systems for AT, taking into account national and sometimes regional contexts and the important role of broader policy and practice settings. For example, in Australia (Steel et al., 2016), Brazil (Maximo & Clift, 2015) and Canada (Ripat & Booth, 2005), the authors note the complex interplay of local, regional and national governments, as well as the intersection between types of government departments. Similar points, albeit to a lesser extent, are made by Dahlberg in relation to Sweden (Dahlberg et al., 2014).

Steel et al. (2016) briefly describes the Australian context for service delivery, but primarily provides a critical analysis of user-centred AT provision (Steel et al., 2016). The study compares traditional and user-centred approaches. Traditional approaches are biomedically focused and link the AT to a disability or diagnosis with the aim to address impairment through provision of the device. However, user-centred approaches are designed

with an understanding of subjective and objective factors that influence how successful the AT user finds the device. User-centred approaches are personalised, and typically prescribed by a health professional following evaluation and engagement with the potential AT user. This approach recognises the importance of psychosocial factors to better enable AT users to adjust to using the technology and incorporate it into their lifestyles. The authors identify several points relevant to the present review. First, public funding for AT generally does not include ‘mainstream’ devices such as computers or phones, despite their vast potential to support user independence. Second is the power differential between practitioners and AT users, and the potential role of ‘peers’ (i.e. expert users or peer mentors’ in enhancing user-centred approaches). Third, there is a strong emphasis on the importance of access to and awareness of AT information for both consumers and professionals. Fourth, the growing role of international web-based databases and access to international markets and fifth, the recognition of the importance of professional assessment and information to assist consumers in navigating local and international markets. Finally, the authors identify a potential gap in the literature in our understanding of the optimum delivery of AT solutions. The literature on choice surrounding the provision of AT is focused on the decision-making of practitioners who provide the AT and the range of devices available. Instead, according to Steel et al. (2016), future research should seek to understand “the relationship between conceptualisations of AT, the context and interpretation of choice in AT provision, the interactions between AT providers and consumers, and experiences of choice for consumers acquiring AT”.

In Sweden, each county has an “Assistive Technology Centre” that acts as a support and brokerage service for professionals selecting AT for their clients. Swedish citizens can access AT free of charge through their National Insurance scheme, and the AT Centres appear to act as gatekeepers and brokers for professionals and AT users. Dahlberg et al. (2014) examined service delivery systems in Sweden. AT Centres throughout Sweden provide expertise and assist prescribers when needed and act as hubs for long-term equipment loans to eligible persons. The authors report on the impact of implementing a voucher system in several counties and municipalities whereby following assessment, consumers were issued a voucher for a specified amount based on the procurement price for the AT appropriate to the assessment. The consumer could then purchase their preferred device with varying degrees of flexibility among the regions. The equipment was typically selected from a pre-procured range of options in the standard process, and ownership remained with the health authority. The study results suggest that users felt the voucher system increased their participation and felt more secure using the devices selected and more satisfied with them. From a policy perspective, the voucher

system provided consumers with access to a wider variety of AT, which may aid in developing a more competitive market as smaller companies have market entry difficulties due to the nature of the procurement system. On the other hand, where local health authorities retain ownership of AT, there is greater opportunity for re-conditioning and re-use of items that are no longer suited to the original recipient, reducing costs and wastage (Dahlberg et al., 2014). In a more recent Norwegian study, Pederson et al. (2020) report on the evaluation of a 'user involvement' model of AT delivery provided in Central Norway from February 2016 to February 2017 (Pedersen et al., 2020). The model of 'user involvement' reported in this paper focuses on the last quality criteria (user influence) that the European Assistive Technology Information Network (EASTIN) recommends in relation to AT selection (Beresford, 2002). This study used a social constructivist approach to describe and understand participants' experiences and meaning when being involved in the user involvement model. Semi-structured and in-depth interviews and focus groups were conducted with 44 people with a disability who used the model when accessing their AT Centre. It was found that service deliverers should initiate information dissemination that is relevant to consumers and facilitate practical testing. It was also found that participants have access to information, particularly from the internet, but the user involvement model is an important approach in ensuring AT users receive the information. Despite this, some participants in the study complained that they did not receive all of the information needed to make an informed decision about AT. Some participants in the study were critical of some aspects of the service but were generally supportive of a model that allowed them to participate in the AT selection process with a 'broker' who was a health professional.

Maximo & Clift (2015) examined the service delivery system in the Belo Horizonte municipalities, a city of 2.5 million persons in Brazil (Maximo & Clift, 2015). Their research had two aims: to identify the characteristics of existing technology services within Belo Horizonte city and to examine the extent to which these services applied user-centred service provision - a key quality indicator in the Association for the Advancement of Assistive Technology in Europe (AAATE) quality framework. Based on qualitative interviews and participant observations across five major service sites, the authors conclude that AT provision conforms to a 'medical model' of service delivery as described by the AAATE, in which only qualified professionals prescribe AT, and public provision is usually regulated. Despite this, there is evidence that Brazil, more generally, is moving toward a social model of disability. However, the system studies in Belo Horizonte relied on individual referrals to centres that

primarily worked from pre-specified equipment lists. Where equipment not on the list is required, clients may purchase the technology privately without support from centre staff or pursue legal means to have the piece of equipment provided through the services. A major finding of relevance to the present review concerned the main changes that users would like to see. The most common change requested was that of the provision of greater knowledge and training. The authors note in their conclusions that a failure to achieve best practice in user involvement in AT selection may lead to inappropriate equipment selection, abandonment of devices and waste of resources (Maximo & Clift, 2015).

Ripat & Booth (2005) describe the preferred AT service delivery system in Manitoba, Canada (Ripat & Booth, 2005). In Manitoba, there is a complex system of AT service delivery, resulting in variability in the availability of AT, AT services, and staff knowledge. The authors used qualitative data gathered in focus groups with providers, funder and users to identify preferred characteristics of the service delivery model. The study highlighted: a) the importance of AT user participation throughout the process; b) that users need to be able to try the technology in their own environment prior to purchase; and c) that both AT user needs and AT itself will change over time, and the service delivery model needs to take this into account. This study also emphasised that AT encompasses not only devices but also the services (evaluation, training, follow-up and maintenance) that support the AT user (Ripat & Booth, 2005). The authors also described a range of instruments that promote collaboration and reduce the likelihood of information asymmetry. For example, the Individually Prioritised Problem Assessment (Wessels et al., 2002), the Matching Person and Technology tool (Scherer & Craddock, 2002) and the Canadian Occupational Performance Measure (Law et al., 1990), have been used to elicit the users' perspective on the goals that he or she would like to achieve by using AT.

A study by Andrich (2007) was carried out in 23 centres participating in the Italian Network of Independent ICT & Assistive Technology Centers (GLIC) during 2005 and 2006 (Andrich, 2007). The study's main aim was to provide insights into services provided, methodologies used, and resources involved. The methods included brainstorming sessions with the managers of all centres and to collect data on the services provided and case histories. The profiles of the AT centres varied, but there were some commonalities. The 'audience' (clients/customers) ranged from less than 20 to over 50 people per month, with staff numbers ranging from 3 to 20 per centre. In order to assist the client with their needs, centres used four strategies: 1) disseminating information through databases, websites, and publications; 2) telephone helplines with experts available at specific times; 3) guidance via phone calls and

face-to-face meetings; and 4) guided visits to the AT centres where each centre has an exhibit of the available AT. In addition, each of the AT centres had the flexibility to offer individual on-site assessments, further enabling AT users to source the most appropriate forms of AT for their situation.

Utley (2006) describes the process of establishing a testing lab and lending library at low cost, focused on AT for low vision and blindness in Oklahoma (Utley, 2006). The author describes the various ways in which AT equipment can be acquired at a low cost to the centre. Utley notes a key distinction that emerged over time between a demonstration centre and a training centre, indicating that both are important. The article emphasises the importance of establishing high quality AT programs.

Type of information, mode of dissemination, and who is the target recipient

Two articles were explicitly focused on web-based platforms to disseminate information about AT, although our supplementary searches found references to additional web-based platforms which are also discussed below. Wouters (2015) describes the development of EASTIN, the European Union national search portal about AT (providing access to product information, addresses of manufacturers and distributors, fact sheets, selection procedures) (Wouters, 2015). The EASTIN Association comprises founding partners (UK, Italy, Germany and Denmark), full partners (Australia, Belgium and France) and multiple affiliates across the world. The portal provides information on almost 70,000 products available on the European market and over 5,000 manufacturers or suppliers. The partners collaborate with National Contacts in fifteen other countries in the European Union and one in Norway, and the National Contacts promote products and the use of AT in their countries by introducing an active dissemination component to the EASTIN project. The portal provides access to consumers as well as professionals.

In the United States, AbleData served a similar function providing information on AT and rehabilitation equipment available from American and international sources (Lowe, 2011). AbleData targets a range of stakeholders, including people with disabilities, their families, disability organisations, and health professionals. Lowe (2011) documents a process of formative evaluation on the website, targeting a variety of system improvements, including enhanced capacity relating to product reviews by consumers. As proposed, the product review system was modelled on features used by large scale internet entities such as Amazon, requesting a user to rate a product in the three areas—value, usability, and reliability—with user comments to support the ratings. Unfortunately, a research search for AbleData suggests

the website was shut down in 2020 due to a realignment of funding resources (<https://www.mobilitywithlove.com/what-happened-to-abledata/>).

In Australia, Assistive Technology Australia (<https://at-aust.org/>) and Independent Living Centres Australia serve a similar function. The Assistive Technology Australia (ATA) website advertises a national service that provides impartial advice and information for consumers relating to AT and offers training for AT users and health professionals. ATA employ health professionals and consumers to advise consumers in choosing AT and are not affiliated with any suppliers of AT. Independent Living Centres Australia host the National Equipment Database (NED) (<https://www.askned.com.au/>). The website is a source of information dissemination and brokerage, providing advice, therapy services, training, and events for AT users and health professionals. NED also functions as a dropshipping service for suppliers where AT users can order their information directly from suppliers through the database.

In the United Kingdom, the Disabled Living Foundation has combined their AT database with a self-assessment tool (AskSARA) (<https://asksara.livingmadeeasy.org.uk/selector>) that generates an individualised report that provides information on relevant AT devices, demonstration centres, and suppliers (Steel & Layton, 2016). AskSARA provides an opportunity for consumers to start with a need or desired outcome for those not aware of the kind of AT they are searching for, as well as subsequent information on product options.

These web-based information dissemination systems address information asymmetry by enabling free access for persons to enable consumers and family members to increase their knowledge of available AT. In the case of AskSARA, there is a further step in providing user-centred advice on potential options suited to the individual. Importantly, web-based systems also open up opportunities for consumers to access international markets in purchasing AT devices, introducing elements of both opportunity and risk.

One of the studies systematically explored the potential of an existing children's television programme called 'Readabilities' to disseminate information about assistive technologies and the kinds of help they can provide to children in several broad disability groups (Arucevic, 2016). The intent was to showcase assistive technologies that may not be well known to the public, linked to specific characters in the television program, to convey information on the value of AT. This paper specifically addresses improved levels of information around assistive technologies for children with disabilities that could contribute to quality of life through the medium of a children's television show.

A study by Blackshear et al. (1987) reported using voice messaging technology using audio text features to make essential AT information and procedures available for people with a disability (Blackshear et al., 1987). Voicemail messaging was relatively new technology at the time) to select services required by the client. The major challenge was accessing the large data bank of aids, devices and independent living procedures. In addition, there was an attempt to develop an original database via nationwide organisations advertisements. As a result of the evaluations and informal feedback, it was determined that future tape recordings should be short and concise with positive language; include information about the latest resources for specific disabilities, manufacturers, and organisations that offer services and assistance; and offer to provide hard copy information.

Where are consumers getting information from vs. where do they say they want to get this information from – what is the impact of different information sources?

An article by Ehrlich et al. (2003) sought to determine the interaction between the sources of information for AT used by people with disabilities in the USA (Ehrlich et al., 2003). In a sample of over 1400 participants, around 64% were identified to be daily AT users. The most mentioned information sources for AT provision were general practitioners/health care professionals (53%), followed by family members (15%) and rehabilitation counsellors (13%). Interestingly, participants in areas with a high population density were more likely to obtain their information from general practitioners/health care professionals, while people in low population density areas were more likely to consult with vocational rehabilitation counsellors. A study by Martin et al. (2011) examined consumer involvement in the pre-purchase decision-making process, their perception of feeling informed and their degree of being satisfied with the use of AT (Martin et al., 2011). The study used a project-specific internet survey completed by people with a variety of disabilities who used AT and online disability networking websites. People with disabilities are increasingly using computers and internet forums to discuss AT and share their experiences. This study highlights the importance of information from peers. Types of AT that consumers were interested in were described. The 145 respondents were primarily from the United States, had a mean age of 45.9 years, and lived with a range of disabilities. The findings show that participants were interested in communication devices (100%), assistive computer-generated software/hardware (94.3%), screen readers (92.6%), aids for daily living (88.1%), and mobility aids (83.9%). Healthcare professionals were considered influential decision-makers for mobility devices (64.5%), listening devices (58.8%), environmental controls (50%), and communication aids (38.5%). Participants were

most likely to obtain their information from three sources: suppliers, the internet, and healthcare professionals. The durable medical equipment suppliers (medical equipment used in the home) were used for information about mobility aids (51%), aids for daily living (31.4%), and respiratory assistance devices (30%). The internet was the primary source about specially adapted computer software/hardware (57.6%), aids for daily living (56.7%), specially modified vehicles (56%), communication aids (50%), environmental controls (52%), screen readers (48%) and mobility devices (46.7%). Healthcare professionals were consulted most often for listening (64.7%) and respiratory devices (50%). Interestingly, the durable medical equipment suppliers were least likely to be sources of information concerning screen readers (4%), listening devices (6%) and specially adapted computer software and hardware (6%). In most cases, the information-gathering activities undertaken prior to purchasing the AT included participants who tested the device themselves talked with other consumers (mostly via electronic means), and studied a range of available options. The most important factor contributing to consumers feeling informed and confident was knowing about the different available options. In contrast, the most frequent response for being not very informed was not having enough information about the product, not knowing the different options, being influenced by the funding source, and not sure where to look for information. These findings highlight the need for independent advice and guidance around the selection of AT.

A study by Racz and Field (2011) surveyed staff and members from the AgrAbility organisation, a national network of farmers and ranchers with disabilities in the United States, to assess their preferred method of receiving AT information (Racz & Field, 2011). In total, 106 AgrAbility staff responded that they access information through the internet (61%), email (60%) and printed publications. Of the 78 members who responded, 92% preferred printed newsletters and 90% preferred printed publications. The preferred sources of AT information for staff included the National AgrAbility database (79%), state AgrAbility projects (68%), and AT vendors (63%). In contrast, the members mostly used AT vendors (59%), followed by the state projects (41%). Staff reported that their most effective strategies for delivering AT information to farmers included providing them with published research and official well-design and up-to-date resources. The authors further recommend that internet resources should be easy to print for members who want to read them offline. In the time since this study was published, the AgrAbility website has expanded and now includes “The Toolbox” (an AT database), a nationwide project directory, resources, training modules, and links to workshops (<http://www.agrability.org/>).

A study by Sund et al. (2013) aimed to investigate user satisfaction of service delivery systems for AT in 50 Danish and 86 Norwegian adults when electric powered scooters were provided (Sund et al., 2013). In the Danish and Norwegian samples, around 50% of informants were 'very satisfied', and less than 6% were 'dissatisfied', respectively, with their access to consulting a health professional to receive adequate information.

A survey by Quinby et al. (2021) aimed to identify the gaps and skills training and knowledge of laws, standards and clinical practice guidelines among consumers of mobility-related AT and to identify consumers' preferred information sources and their function as part of a pilot study to develop a framework for effective research dissemination and knowledge translation (Quinby et al., 2021). A total of 100 participants, including 82 United States Veterans, completed the survey, with most participants having used their mobility device for more than 6 years. The findings indicated the largest knowledge gaps in awareness of new technologies, AT assessment tools and clinical practice guidelines. The most important sources of AT information included word-to-mouth (veteran peers, family/friends using AT) (48%), clinicians (17%), the internet (16%), conferences and events (7%), social media (5%), and magazines (5%). Facebook and Google Search were common internet sources of information. The authors suggested that the internet should focus efforts to increase awareness of the use and benefits of AT.

Freiesleben et al. (2021) investigated the barriers to adopting technologies in dementia as described by key professional stakeholders in a focus group format with participants in Berlin, Germany (Freiesleben et al., 2021). A focus group with 22 professionals from business (n=7), healthcare (n=6) and research (n=9) who worked in gerontology was undertaken to evaluate opinions on the value of using locating technology in dementia care and barriers to using the technology. Six themes emerged relating to adoption barriers and five themes relating to service information dissemination strategies. The information relevant to this review is included in one theme in relation to adaptation barriers and that is "awareness limitation." Some relevant quotes supporting this theme are: "I can't use what I don't know exists. That is the main problem I learned after conducting 105 interviews [with people with dementia]." In addition, "From the perspective of end users, this is a product that I don't know, that is unfamiliar. Product awareness is still largely inadequate." Another quote was, "General practitioners don't have an overview of all commercially available products." This is relevant to information asymmetry as the theme "awareness limitation" describes elements of information asymmetry. It describes experts' knowledge about what they believe is a useful product, but the end-user has minimal knowledge of the potential benefits. In this sense, it is

different from the exact definition of information asymmetry thinking; someone gains an advantage (i.e. selling a product) from the information they know. In this case, the stakeholders (consumers, brokers of AT, and health care professionals) want the information they hold to be readily available and accessible so that potential AT users are empowered to make more informed choices about what could be beneficial to them.

Consumer involvement in the development of assistive technology delivery models

Craddock & McCormack (2002) used a series of seven case studies to describe the development of an AT model for people with disabilities using client-focused and participatory principles (Craddock & McCormack, 2002). The model focuses on using an outreach model of AT assessment and advice given by multiple ‘Technical Liaison Officers’ (TLO) in Ireland. All of the TLOs had a disability which the authors say adds to the authenticity of the impartial advice being given. The seven case studies described in the paper describe how the TLOs provided information to seven people in Ireland with disabilities and their families about AT (primarily computer-based AT). All of the case studies highlight to varying degrees: 1) the lack of information the participants had prior to the TLO visit; 2) the assessment/information and advice the TLO gave was impartial as they were not selling the products, and 3) all of the seven people and their families were satisfied with the TLO service meaning they were happy with the approach the TLO took and the resulting product/change or advice assisted them to use AT to meet a specific need. This study relates to information asymmetry as it highlights the lack of information available to people in Ireland at the time of publication when looking for and/or being assessed for AT. It also relates to brokerage as the model uses TLOs to assess AT suitability and provide impartial advice to people with a disability. The TLOs appeared to have no vested interest in selecting or recommending specific products.

The Equipment and Assistive Technology (EATI) (Canada) is a consumer-led AT program that uses a ‘participation model’ where professionals and consumers are involved in a collaborative assessment and selection process for AT users (Johnston et al., 2014). The EATI employs caseworkers, known as ‘Navigators’, to work directly with potential users as an overt form of brokerage. The role of the ‘Navigator’ is to give consumers as much information as possible about a range of products that could potentially meet their needs. Importantly, EATI does not have an approved list of AT that consumers must choose from. Instead, the user works with the Navigator to choose the more appropriate AT for their condition. The EATI program was evaluated in a survey of 408 users and an interview with 16 participants. The survey reported that the participation model was the most successful approach, which was confirmed

in the interviews. In addition, participants placed high value on the role of the ‘Navigator’ in the selection process, leading to higher use of the selected AT. This paper is relevant to brokerage as it evaluates a program that allows consumers to be active participants in the AT decision making process. The program has several defining features of an impartial brokerage AT service, including having trained professionals guiding the consumer through the process, not selling products and not restricting choice to specific products. It also indirectly relates to information asymmetry as it implies that professionals working in the AT space will usually have more experience and knowledge about specific processes and products. The role of the professional is to impart that knowledge impartially, so the consumer has as much information as possible to make an informed decision. There is also an economic implication from this paper, as there are papers cited reporting the correlation between equipment abandonment and poor assessment and selection processes. Specifically, when consumers are not consulted or involved in the AT selection process, they are more likely to abandon their equipment, which has obvious implications for financial, health, and quality of life.

A study in the United Kingdom described the development of a business approach involving brokerage to people aged 50 -70 years to provide them with electronic assisted living technologies (eALT) (Ward et al., 2017). A mixed-methods approach was used, which involved market analysis, product reviews, a survey of 500 consumers, consumer focus groups, consumer and business co-creation groups, business interviews and focus groups, telephone surveys of business (n=103) and business model development and validation. The study found that a lack of available information for the 50-70 year old AT users was a key barrier to purchasing eALT and that more accessible, high-quality information was desired to increase their confidence in making a purchase. Furthermore, the market analysis revealed that due to a small number of suppliers, the prices of eALT products varied widely, creating further uncertainty for potential AT users. A brokerage model was determined to be most appropriate by the survey respondents, focus groups, and business experts to reduce these barriers. In addition, it highlighted that independent advice from a broker was preferred over an insurance-based model. This finding highlights that information asymmetry was present in the selection and purchase of eALT and that both consumers and business experts agree that the brokerage model is more appropriate for the selection of AT.

A study by Mirza & Hammel (2009) examined the effect of an AT and environmental intervention's effect on older people with intellectual disabilities (Mirza & Hammel, 2009). In this study, 75 community-dwelling people in the USA aged 30 years and over were randomised into the ATLAS program, with the other 47 participants receiving usual AT services. The

ATLAS intervention programme is a consumer-directed, collaborative problem-solving approach to adapt the physical and social environments to meet specific needs. It consists of five sessions over three months facilitated by an occupational therapist, focussing on the participants' community-based goals and strategies to meet these goals, which can include AT. The consumer directed approach was used as it is a model that enables consumers to make informed choices about the service they are receiving (Nadash, 1998). This included an assessment of their needs, how the needs will be met, and quality monitoring. The group that received the intervention had an improvement in self-reported satisfaction and performance with the AT. This shows that a consumer-directed approach is effective when assessing and selecting AT for people with intellectual disabilities.

Lane & Stone examined the dissemination process of AT through three randomised controlled case studies (Lane & Stone, 2015). Each of the studies included researchers, clinicians, manufacturers, consumers, and brokers to evaluate whether passive diffusion, targeted dissemination, or tailored translation were best in communication of research findings on AT. The authors concluded that dissemination targeted to specific stakeholders, regardless of whether the information is specifically tailored to the recipient, effectively improves knowledge levels in contrast to passive diffusion.

Challenges with accessing assistive technology and the role of information asymmetry

A study by Gramstad et al. (2013) interviewed nine people aged over the age of 69, living at home in Norway about their unmet AT needs (Gramstad et al., 2013). They proposed that unmet AT needs are influenced by an individual's knowledge of AT, sociocultural factors, and their experience of a disability. This study was part of a more extensive study that described the participants' experiences throughout the journey of AT assessment, intervention and evaluation. This sub-study related to the time when participants had applied for AT, including lift chair, bidet, walker, powered scooter and sock puller, but the AT was not in place yet. The data generated three themes. The theme of 'getting the idea' encapsulates the idea that the information provided to the participants about their AT was provided by chance, and they delegated decision making regarding obtaining the AT to others, mainly family.

In the broader study mentioned above, Gramstad and colleagues (2014) reported on three qualitative interviews with each of the nine older people in relation to the AT process they had just experienced over 18 months (Gramstad et al., 2014). The first interview occurred before the AT was delivered, the second after delivery, and the final interview at least two months after the delivery date. The data generated four themes, which is "taking charge or

putting up”. In this theme, some participants describe how the AT did not work or was not fit for purpose. When they attempted to contact the occupational therapist who recommended the technology for more information, they did not get the required information to fix the situation. This article highlights that the people holding the information about the technology (e.g. the occupational therapist) were not selling the products, which is a benefit to the user in that it reduces bias associated with potential financial gain, but also means they cannot intervene to assist if something goes wrong in the purchase process.

A dissertation by Newton (2002) reported barriers to implementing AT in schools and reports the benefits of a team of AT advisors in overcoming these barriers (Newton, 2002). The dissertation reports the results of individual interviews and focus groups of 17 participants based in a school district in the USA. These participants included 4 members of a school focused approach to AT provision and 13 teachers working with children with physical and intellectual disabilities. The literature review reports a barrier to AT use as “information dissemination”, noting that end-users “often have difficulty keeping abreast of developments in the AT field.” A section of the findings describes how information dissemination can be a barrier to effective AT selection and use. The qualitative remarks from participants highlight the specialised nature of AT. The AT team had the knowledge and experience of AT to assist children that teachers did not have. Teachers reported that the specialised nature of AT and the constant changing of technology meant they relied on the AT team to provide them with up to date information about AT. In addition, teachers reported that the AT team assisted them in providing appropriate AT to their students. Specific parts of this dissertation relate the brokerage and information asymmetry. The model of AT assessment and selection involved a specialised AT team advising teachers. In this sense, they were offering a brokerage service by giving impartial advice (as they were not selling AT) to teachers who did not have the specialised knowledge to make the best selection of AT for their students. The findings describe two groups of people, one of whom has specialised knowledge of AT (the AT team) and teachers who need AT for their students who did not possess this knowledge. In this case, the AT team acts as brokers for the teachers to counteract information asymmetry when purchasing AT.

The paper by Tsertsidies (2021) aimed to investigate the structural problems and challenges of delivering digital technologies to people with dementia in Sweden (Tsertsidis, 2021). The paper uses the Consumer-directed Theory of Empowerment (Kosciulek, 1999) as a theoretical framework to support the notion that involving consumers in the details of their care will result in better outcomes. A qualitative methodology was used (face to face interviews

and focus groups) with 11 participants consisting of occupational therapists, support workers, a researcher and spouses of people with dementia. Relevant to this review was the “information and support about digital technologies” module of the Consumer-directed Theory of Empowerment and how that contributes to the AT selection process. Findings in the paper relating to information and support about digital technologies revealed that there were opinions that some occupational therapists were ‘scared’ of technology with the inference that they did not give the most appropriate information to consumers. Consumers mentioned that there was confusion at times regarding the information being received. This paper describes how families of people with dementia may not have or receive the most appropriate information regarding digital technologies. In addition, involving people with dementia in the process of selecting digital technologies was considered to be beneficial.

A study by Borg and Östergren (2015) investigated the challenges and potential solutions for the equitable provision of AT in resource-limited environments (Borg & Östergren, 2015). This was achieved by describing the sources of awareness, types of providers and costs of AT; describing common reasons for not possessing AT; and comparing the sources, providers, costs and reasons among younger and older populations living in urban and rural settings of Bangladesh. The study was conducted from 2006 to 2010 as a part of the ATpar study. The main findings indicated that older hearing aid users, to a larger extent than younger users, reported that traditional sources of awareness were more beneficial than a traditional provider, and this was associated with the cost of the hearing aid. Compared to younger users, older wheelchair users more frequently received their wheelchair from a traditional provider. Among hearing aid users, community-based rehabilitation (CBR) workers (predominately women, rural dwellers, younger age group and illiterate respondents), doctors and nurses (predominately men, urban dwellers, older age group and literate responders) were the major sources of AT awareness. Among both groups of users, government facilities provided about 1% of the AT. Around two-thirds of hearing aid users and three-quarters of wheelchair users received their AT from the NGO facilities, and most users have received AT free of charge. Interestingly, one of the main reasons for not possessing AT was cost. In addition, to ensure equitable provisions of AT, several factors also have to be considered, such as age, gender, impairment of the individual and socioeconomic status. Another study by Borg et al. (2021) measured user involvement in the service delivery process in Bangladesh (Borg et al., 2012). This study collected data from 136 users of hearing aids and 149 users of manual wheelchairs. The findings indicated that user involvement in the service delivery process included asking about their preferences and providing training on the use and maintenance of hearing aids

increased the likelihood of reporting better outcomes. User involvement in the provision of manual wheelchairs showed that those asked their preferences had fewer limitations in their daily activities.

Evaluation of the activities provided by wheelchair providers was also the focus of a study by Sprigle et al. (2012), which aimed to document the type and duration of activities performed by wheelchair suppliers during the provision of wheeled mobility and seating devices (Sprigle et al., 2012). Data were collected from 500 client interactions resulting in 864 complex rehabilitation technology (CRT) activities or standard wheeled mobility equipment (STD). The majority of the activities were relatively short (around 15 minutes), and there was a difference in time related to the device complexity. Furthermore, the provision of complex wheeled mobility and seating equipment requires more time, on average, than providing standard wheeled mobility and seating equipment.

Scherer et al. (2005) undertook a validation of a consumer self-rating tool measuring psychosocial attributes and motivation as a predictor of AT use and the match of AT and users (Scherer et al., 2005). The Assistive Technology Device Predisposition Assessment (ATD PA) measure identifies key personal and psychosocial characteristics and quality of life and predicts an individual's predisposition to use a particular form of AT.

A study by Cowan and Turner-Smith (1999) reported on the experiences of 135 people with a physical disability that use a variety of electronic AT such as powered wheelchairs, equipment for communication and environmental control systems (Cowan & Turner-Smith, 1999). Participants were using an average of just under 3 forms of AT per person. The most common items included powered wheelchairs, environmental control systems, hoists and computers. The most common referral methods for the provision of the AT were respondents themselves and their carers, followed by Occupational Therapists (hospital and social services); care managers, speech & language therapists, schools, physiotherapists and consultants; general practitioners; and community nurses. The time interval between the referral and installation varied across the equipment and systems from one week to 3 years for environmental control systems, a few weeks to 4 years for powered wheelchairs, and 1 week to 2 years for hoists. The participants were also asked to comment on problems with accessing AT, which were clustered into the following themes: 1) funding issues and funding sources; 2) lack of information on the devices available (where to access the device and receive a demonstration); delays in provision; and support on maintenance and training on the use of the device.

6. An environmental scan of Assistive Technology Services

In addition to the scoping review of peer-reviewed articles, an environmental scan of some international AT services and resources was completed. No attempt has been made to critique the information on these sites; the information provides an entry point to the scale and scope of AT services and resources around the world.

Table 1 describes some of the available services and a brief description. The common features of these services are that they claim to provide independent advice for people when selecting AT. Some provide information through databases only, while others provide independent AT experts to help clients navigate the AT selection process.

Table 1. Examples of Assistive Technology Services and Resources

Country/ Continent	Title	Practice characteristics	Website
Africa	Southern Africa Assistive Technology Database	This is a database funded by Google Impact Challenge that uses field officers (called ‘admins’) to collect data about AT and make it available to be viewed on a mobile app or computer for free. The site also lists suppliers of equipment and service providers.	https://assistivetechmap.org/
Australia	National Equipment Database (NED) ATA Australia	In Australia, there are two national AT databases providing independent advice. They are owned and managed by Indigo Solutions Australasia and Assistive Technology Australia. Both organisations have showrooms (in Perth for Indigo Solutions and Sydney for ATA) of AT products. Health professionals provide assessment and advice around AT products but do not sell products.	https://ilcaustralia.org.au/search_category_paths https://at-aust.org/
Europe/ Australia	Global Assistive Technology Information Network (EASTIN)	EASTIN is a global technology information network with full partners being Italy, the UK, Germany, Denmark, France, Australia and Belgium. The organisations in partner countries supply their databases to the EASTIN portal for consumers to search. EASTIN directs queries to affiliates including Israel, Lithuania, Cyprus, Thailand, Latvia, Taiwan and The Netherlands Consumers can access the EASTIN database to obtain information about assistive technology. There is an inquiry function where a member of EASTIN will answer consumers' specific questions about AT. The individual partner organisations (and the affiliate member listed in the next tab) have locally based services. Some of these services (such as ATA in Australia) employ health	http://www.eastin.eu/en-gb/searches/Products/Index Partners: UK: https://www.dlf.org.uk/ Italy: http://www.dongnocchi.it/ Germany: https://www.iwkoeln.de/ Denmark: http://www.socialstyrelsen.dk/ Australia: http://www.at-aust.org/ Belgium: http://www.vaph.be/ France: http://www.hacavie.com/

		professionals to advise consumers in addition to the database searching functions.	
Various (EASTIN affiliates)	EASTIN affiliate organisations	As above	Israel: https://azarim.org.il/ Lithuania: http://www.tpnc.lt/ Cyprus: http://www.euc.ac.cy/ Thailand: http://www.nstda.or.th/ Latvia: www.vtpc.lv/ Taiwan: http://www.treats.org.tw/ Slovakia: http://accesscentre.tuke.sk/ The Netherlands: www.innovatiesindezorg.eu/
United States of America	Centre for Assistive Technology Act Data Assistance – AT demonstration centers	<i>“State and Territory Assistive Technology Programs focus on improving the provision of Assistive Technology (AT) through comprehensive, statewide programs that are consumer responsive. The goal of these programs is to increase access to and acquisition of AT. Programs serve people with all types of disabilities, of all ages, in all environments.”</i>	https://catada.info/
New Zealand	Enable New Zealand	<i>“Enable New Zealand provides disability services in New Zealand. We are a division of MidCentral District Health Board. The Ministry of Health and ACC contract us to provide:</i> <ul style="list-style-type: none"> • <i>Disability information services</i> • <i>Disability equipment</i> • <i>Housing modification and vehicle modification services.”</i> 	https://www.enable.co.nz/
Ireland	Enable Ireland	Brokerage based service to children and adults with disabilities based upon the Social Model of Disability. See: https://www.enableireland.ie/sites/default/files/publication/Enable%20Ireland%20Annual%20	https://www.enableireland.ie/

		Report%202018_Web_Use-HR%20FINAL.pdf	
Italy	Fondazione Don Carlo Gnocchi	<i>“The Italian Web Portal providing information and guidance on assistive technologies for independence, quality of life and participation of persons with disabilities. A systematic and up-to-date review of assistive technology products available in Italy and in Europe.”</i>	http://portale.siva.it/en-GB/home/default
China	China Disabled Person’s Federation	The website does not work, but from secondary sources, the CDPF: <i>“The three basic functions of the CDPF are to represent the interests of people with disabilities in China and help protect their legitimate rights, to provide them with comprehensive and effective services and to supervise affairs relating to people with disabilities commissioned by the Chinese government”</i>	http://www.cdpf.org.cn/
Taiwan	TREATS (Taiwan Rehabilitation Engineering and AT Society)	<i>“Taiwan Rehabilitation Engineering and Assistive Technology Society, TREATS, was established in 2011. Our members include experts and scholars from various fields such as medical physician, rehabilitation engineering, physiotherapist, occupational therapist, special education, social workers, and etc. Our missions are mainly</i> <i>(1) to assist the government to develop AT policies,</i> <i>(2) to participate in international affairs and related activities, and</i> <i>(3) to host relevant conferences or activities to promote AT affairs</i>	http://treats.org.tw/Contactus.php?Lang=2
Japan	Display centre, information service, and Hyogo Assistech	<i>“The Association promotes research and development on welfare equipment, collects and provides information on welfare equipment, clinically evaluates welfare equipment, trains welfare equipment-related technicians, and conducts examination work related to artificial limb equipment. The purpose is to promote the safe and effective use of assistive devices and contribute to the promotion of the welfare of the elderly and the disabled.”</i>	http://www.techno-aids.or.jp/ https://www.hyogo--an-com.translate.goog/index.ht

		Hyogo Assistivetech is another organisation in Japan that is a network of organisations offering information about assistive technology.	ml? x tr sl=ja& x tr tl=en & x tr hl=en-GB& x tr pto=nui,op,sc
Singapore	Tech Able	<p><i>“Tech Able is a joint initiative between SG Enable and SPD. Comprising an assessment centre, an assistive device library, a smart home/office technology showcase and an event space, Tech Able aims to :</i></p> <ul style="list-style-type: none"> • <i>Provide information and resources on assistive and infocomm technologies (AT/ICT);</i> • <i>Promote the adoption of AT/ICT among persons with disabilities and employers;</i> • <i>Leverage technology for more training and employment opportunities for persons with disabilities.”</i> 	https://techable.enablingvillage.sg/aboutus

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